Exercises lecture 2

Formal languages, grammars, and automata

27 april, 2013

2. Regular languages, Finite Automata

Read: Chapter 2, pages 5–8 of the Reader Ruohonen; the slides of the course on the webpage.
Exercise 3 can be handed in with Nico Broeder or Jasper Derikx.

1. Let M be the deterministic finite automaton (DFA) given by

   $$\langle Q, \Sigma, \delta, q_0, F \rangle$$

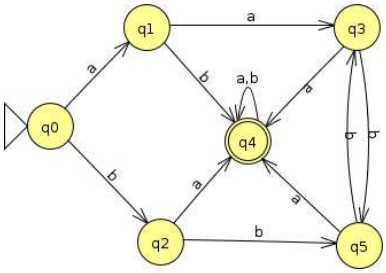
   with $\Sigma = \{a, b, c\}$, $Q = \{q_0, q_A, q_B, q_C\}$, δ given by the table

δ	q_0	q_A	q_B	q_C
a	q_A	q_0	q_C	q_B
b	q_B	q_C	q_0	q_A
c	q_C	q_B	q_A	q_0

   and $F = \{q_0\}$.

   (a) Make a state transition diagram for M.
   (b) Determine for the following words whether they belong to $L(M)$: $abba, baab, bac, cac$.
   (c) Give a regular expression e such that $L(e) = L(M)$.

2. Let a DFA M be given by
   (a) Describe the words accepted by M.
   (b) Give a regular expression e such that $L(e) = L(M)$.



3. $\Sigma = \{a, b\}$.

   (a) Give a DFA that accepts $L_1 := \{w \in \Sigma^* \mid w \text{ does not contain } ab\}$, and prove that your answer is correct.
   (b) Give a DFA that accepts $L_2 := \{w \in \Sigma^* \mid w \text{ every } a \text{ in } w \text{ is directly followed by a } b\}$ and prove that your answer is correct.
   (c) Give a DFA that accepts $L_3 := \{w \in \Sigma^* \mid w \text{ contains } aa \text{ twice}\}$. (Be ware of aaa.)